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EDITORIAL

Diastolic dysfunction: a comparison of 2025 ASE, 2024 BSE and 2022 EACVI guidelines

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Left ventricular (LV) diastolic function is a complex physiological state that cannot be accurately characterized by a single non-invasive parameter. Instead, multiparametric assessment strategies have been proposed, incorporating a range of echocardiographic and clinical variables. Although existing guideline documents differ in certain methodological details, they converge on addressing two clinically and prognostically important questions: (i) how to define the presence of diastolic dysfunction, and (ii) how to estimate LVFP. These dual objectives form the cornerstone of current diagnostic frameworks and reflect the central role of diastolic function assessment in guiding clinical decision-making and risk stratification.

2025 ASE guidelines

The 2025 American Society of Echocardiography (ASE) guidelines[1] represent a notable evolution in the evaluation of LV diastolic function, introducing a more structured and nuanced stepwise algorithm compared with previous iterations. Central to the updated approach is the initial identification of impaired myocardial relaxation, which is pragmatically defined by a reduction in average mitral annular e′ velocity ≤6.5 cm/s, alternatively septal e′ ≤ 6 cm/s or lateral e′ ≤7 cm/s when only one of the two is measured, though age-specific cut-offs are recommended for optimal accuracy. Following this initial step, the assessment proceeds by evaluating markers indicative of elevated LVFP and chamber remodelling. These include an average E/e′ ratio >14, left atrial reservoir strain (LARS) ≤ 18%, an E/A ratio ≤0.8 or ≥2, and a left atrial volume index (LAVI) > 34 mL/m^2. The presence of impaired relaxation in conjunction with any of these markers confirms the diagnosis of diastolic dysfunction. Notably, the diagnosis can also be made in the absence of impaired relaxation if two or more of these additional markers are present. Importantly, tricuspid regurgitant (TR) velocity is not incorporated into this diagnostic algorithm for defining diastolic dysfunction.

For estimating LVFP, the guidelines recommend as a first step a tripartite approach based on mitral e′ velocity, E/e′ ratio, and either TR velocity or estimated pulmonary arterial systolic pressure (PASP).[1] Concordance among these parameters allows for a clear classification of normal or elevated LVFP. In cases of discordance, a set of secondary parameters is used to resolve ambiguity. These include LAVI, pulmonary vein flow, LARS, and isovolumic relaxation time. Additional measurements such as the presence of an L wave, pulmonary regurgitant velocity, and others may be useful in select cases. Age-independent indices, such as changes in mitral inflow velocities during the Valsalva manoeuvre or the duration difference between pulmonary vein atrial reversal (Ar) and mitral A wave, offer further diagnostic refinement. This comprehensive multiparametric approach aims at minimizing indeterminate diastolic function classifications.

A major innovation in the 2025 guidelines is the incorporation of LARS as a routine component for both the diagnosis of diastolic dysfunction and estimation of LVFP.[1,2] The guidelines also provide refined recommendations for assessing diastolic function in specific clinical populations, including heart transplant recipients, patients with pulmonary hypertension (PH), individuals with atrial fibrillation (AF), and those with specific cardiomyopathies.[1]

Exercise stress testing is given a prominent role in the updated guidelines, particularly for patients with unexplained dyspnoea and either grade 1 diastolic dysfunction or indeterminate LVFP at rest.[1,3,4] The recommended modalities include supine bicycle or treadmill stress echocardiography. Baseline measurements should include mitral E and e′ velocities as well as TR velocity, with agitated saline contrast used if necessary. These parameters are reassessed during peak exercise or within 1–2 min post-exercise, when E and A wave fusion is absent. A test is considered positive if the average E/e′ exceeds 14 (or septal E/e′ > 15) and peak TR velocity exceeds 3.2 m/s, suggesting exercise-induced elevation in LVFP.

The 2025 guidelines also propose a structured diagnostic algorithm for suspected heart failure with preserved ejection fraction (HFpEF). Initial evaluation should incorporate clinical data, chest imaging, and natriuretic peptide levels to assess the likelihood of a cardiac aetiology for dyspnoea.[1] A comprehensive echocardiographic examination should then be performed, including assessment of LV global longitudinal strain (GLS) and LARS. Before confirming a diagnosis of HFpEF, alternative aetiologies such as significant valvular disease, coronary artery disease, non-cardiac PH, hypertrophic or infiltrative cardiomyopathies, and pericardial constriction should be excluded. If echocardiography demonstrates elevated LVFP at rest in a symptomatic patient, HFpEF is diagnosed. If resting LVFP is normal, diastolic stress echocardiography is the next step. In cases where non-invasive testing remains inconclusive, right heart catheterization with or without

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exercise may be pursued. A positive haemodynamic response confirms HFpEF, while a negative result suggests a non-cardiac origin for the patient's symptoms.

2024 BSE guidelines

The 2024 British Society of Echocardiography (BSE) guidelines[5] place significant emphasis on recognizing clinical contexts in which impaired myocardial relaxation is highly likely, thereby allowing diastolic dysfunction to be assumed without strict reliance on conventional criteria. Such conditions include impaired left ventricular systolic function, defined by LVEF <50% and absolute GLS <16%. The guidelines also acknowledge the presence of a 'grey zone' for both parameters, where additional echocardiographic and clinical information is required to confirm diastolic dysfunction. Beyond impaired systolic function, impaired relaxation can be presumed in patients with pathological LV hypertrophy, known myocardial disease, or substantial regional wall motion abnormalities. In these high-likelihood scenarios, the diagnostic focus should shift toward the assessment of LVFP. In these cases, LVFP are evaluated using three primary echocardiographic markers: average E/e′ ratio >14, TR velocity >2.8 m/s, and LAVI >34 mL/m^2. In cases where these markers yield indeterminate results, additional parameters should be incorporated, with left atrial strain serving as the preferred initial tiebreaker. Furthermore, in patients with impaired relaxation and normal resting LVFP, diastolic stress testing may be indicated to unmask exertional abnormalities.

In patients with preserved systolic function and no obvious myocardial disease, the diagnostic algorithm begins with the same three core variables: average E/e′ > 14, TR velocity >2.8 m/s, and LAVI >34 mL/m^2. If the majority of these values are within normal range, mitral annular e′ velocity should be assessed using age-specific reference values. A reduced e′ velocity in this context indicates the presence of diastolic dysfunction with normal LVFP. Conversely, if the majority of the three primary variables are abnormal, a diagnosis of diastolic dysfunction with elevated LVFP is established. For intermediate or inconclusive cases, additional markers are again recommended, with LA strain serving as the initial adjudicating parameter.

Consistent with the approach outlined in the 2025 ASE guidelines, the BSE also highlights specific clinical scenarios in which standard algorithms may not apply, such as patients with PH and those in AF.[5] In these populations, tailored assessment strategies are necessary.

2022 EACVI statement

The 2022 European Association of Cardiovascular Imaging (EACVI) consensus statement[6] provides important updates on the role of multimodality imaging in the evaluation of patients with HFpEF. The proposed diagnostic workflow begins with a basic clinical assessment aimed at excluding non-cardiac causes of symptoms and identifying specific cardiac aetiologies. Comprehensive transthoracic echocardiography is emphasized as a first-line tool to evaluate cardiac structure and function, rule out alternative diagnoses, identify specific HFpEF phenotypes (e.g. hypertrophic cardiomyopathy, amyloidosis), and guide the need for additional imaging modalities such as cardiac magnetic resonance or nuclear imaging. In the absence of a specific phenotype, the estimation of LA pressure becomes the central focus, both at rest and, if

Table 1 Comparative table of main points from diastolic dysfunction guidelines

Parameter	EACVI 2022	BSE 2024	ASE 2025
Abnormal e′ velocity, cm/s	Septal < 7, lateral < 10	Age-related adjustment recommended Sex-related adjustment noted	Septal ≤ 6, lateral ≤ 7, or average ≤ 6.5 Age-related adjustment suggested
Average E/e′ cut-off	>14	>14	≥14 Septal ≥ 15, lateral ≥ 13
TR velocity m/s PASP mmHg cut-off	TR > 2.8	TR > 2.8	PASP ≥ 35 TR ≥ 2.8 if atrial pressure unavailable
Abnormal LAVi mL/m^2	>34	>34	>34 Adjudicator, not primary triad
Abnormal LARS/PALS	≤18% Additive or replacement parameter	≤18% Additive or replacement parameter	≤18% Adjudicator, not primary triad ≤ 19–24% borderline values
Pulmonary vein S/D ratio	May be considered	May be considered	S/D ≤ 0.67, systolic fraction ≤40% Adjudicator, not primary triad
IVRT ms cut-off	Not routine	May be considered	≤70 Adjudicator, second tier
Grading diastolic dysfunction	Retains grading framework (I, II, III)	Deemphasizes grading	Retains grading framework (I, II, III)
Special populations	HFpEF focused, multimodality assessment encouraged	Tailored sections Dedicated algorithms (AF, PH)	Tailored sections Dedicated algorithms (AF, PH, constriction, MAC, transplant)

AF, atrial fibrillation; ASE, American Society of Echocardiography; BSE, British Society of Echocardiography; EACVI, European Association of Cardiovascular Imaging; HFpEF, heart failure with preserved ejection fraction; IVRT, isovolumic relaxation time; LARS, LA reservoir strain; LAVi, left atrial volume indexed; LVFP, left ventricular filling pressures; MAC, mitral annular calcification; PALS, peak atrial longitudinal strain; PASP, pulmonary arterial systolic pressure; PH, pulmonary hypertension; S/D, systolic/diastolic; TR, tricuspid regurgitation.

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necessary, during exercise. In patients with inconclusive findings, the use of a validated HFpEF diagnostic score (e.g. H2FPEF) is recommended to stratify likelihood and guide further evaluation. Those with intermediate scores may benefit from diastolic stress testing or invasive haemodynamic assessment to confirm the diagnosis.

The diagnosis of diastolic dysfunction requires a nuanced and integrative approach. Clinical risk factors (such as age, obesity, hypertension, and diabetes), echocardiographic features (including LA enlargement, left ventricular hypertrophy, and regional wall motion abnormalities), and biomarker data (elevated natriuretic peptides) should all be considered in assessing the pre-test probability of HFpEF. GLS is recommended in all patients, as impaired longitudinal function indicates left ventricular systolic dysfunction. The statement endorses a four-variable echocardiographic approach mirroring the 2016 ASE/EACVI guidelines for the diagnosis of diastolic dysfunction.[7] These include mitral annular e′ velocity, E/e′ ratio, LAVI, and TR velocity. This multiparametric strategy enables classification of diastolic function while recognizing the limitations of individual parameters.[7–9]

For the estimation of LVFP in patients with suspected cardiac disease, the EACVI statement proposes an algorithm beginning with the mitral E/A ratio. An E/A ratio ≤0.8 typically indicates normal LVFP, while a ratio ≥2 suggests elevated pressures. However, in younger individuals, an E/A ratio ≥2 may be normal unless accompanied by a reduced e′. Intermediate values require the integration of additional parameters, E/e′ ratio, LAVI, and TR velocity to refine the assessment. LARS may provide further diagnostic support in ambiguous cases, particularly when traditional parameters are discordant. Similar to other guidelines, this algorithm should not be applied to specific situations that require a dedicated approach (AF, pacing, etc.).

Methodology for LVFP

There is a growing body of evidence regarding the definition and evaluation of elevated LVFP. The 2025 ASE guidelines propose a unified initial triad, mitral annular e′ velocity, E/e′ ratio, and TR velocity or PASP followed by a formal adjudication stage in which LA strain has an important role. As a consensus, it is recommended to systematically acquire and report all relevant measures, including mitral E/A ratio, E-wave deceleration time, septal and lateral e′ velocities, average E/e′ ratio, TR peak velocity (for PASP), LAVi, and LA reservoir strain, when feasible. Pragmatically, LVFP can be considered elevated when E/e′ > 14, TR velocity >2.8 m/s, and LAVi >34 mL/m^2. In cases of discordance or indeterminate findings, LA reservoir strain (LARS ≤18%) supports the presence of elevated LVFP. If uncertainty persists, additional adjudicating parameters (pulmonary vein S/D ratio, IVRT/TE-e′, etc.) can be incorporated, alongside biomarkers (BNP/NT-proBNP) and clinical pre-test probability. When symptoms remain unexplained despite normal resting LVFP, diastolic stress echocardiography or invasive haemodynamic assessment should be considered.

Using only one of the 3 or 4 parameters weakens accuracy. Interestingly, during the validation of the algorithm by Lababidi *et al.*,[10] authors used two or more of the additional parameters. Furthermore, in a study in 450 patients,[11] the authors clearly showed the weakness of LAVI as a single marker of LV filling pressure. That is why trusting just one parameter is not great for accuracy of LVFP assessment.

Clinical implications

The 2025 ASE guidelines provide a comprehensive framework for the assessment of diastolic dysfunction, integrating a clearly defined stepwise algorithm with a global approach that incorporates echocardiographic indices, biomarkers, and the underlying clinical pathology. Left atrial strain has emerged as a useful predictor of elevated LVFP. Importantly, the proposed algorithm for LVFP assessment has been validated in a large study using invasive LVFP as the reference standard, demonstrating good diagnostic accuracy across a wide spectrum of left ventricular ejection fraction, with excellent feasibility. Care should also be taken for the TR velocity to be interpreted in the context of other parameters. As has been demonstrated,[6] incorporating an estimate of RA pressure improves the PASP estimation.

Table 1 summarizes the key cut-off values recommended in the compared guidelines. Looking ahead, future advances are likely to focus on refining the interplay between invasive and non-invasive modalities, improving diagnostic accuracy, and enabling a more individualized approach. A particularly important perspective introduced in the 2025 ASE guidelines is the emphasis on clinical context, including the adjunctive role of biomarkers such as natriuretic peptides (e.g. NT-proBNP), which have been shown to add diagnostic value in assessing LVFP, as demonstrated by Lababidi and colleagues.[10]

Conflict of interest: J.G. has received honorarium from Medtronic and Siemens for lectures not related to this topic and she is deputy editor for EHJ—CVI. O.A.S. is co-inventor of 'Method for myocardial segment work analysis', is co-inventor of 'Estimation of blood pressure in the heart' and has received one speaker honorarium from GE Healthcare. O.A.S. has been co-authoring consensus documents and clinical practice guidelines that are discussed in this article, and he is Senior Associate Editor for EHJCVI.

Data availability

No original research data were employed in this manuscript.

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